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STUDY OF PRE-CERAMIC MAIZE FROM HUARMEY, NORTH CENTRAL COAST OF PERU

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In 1960, Harvard University received a collection of maize samples from the Valley of Huarmey in the north central coast of Peru. These samples represented prehistoric specimens and were sent by David H. Kelley, who at the time was associated with West Texas State University, and by Duccio Bonavia, who then was an associate research worker at the Institute of Anthropological Investigations of Lima.

Although these samples were studied almost immediately, due to a series of circumstances the publication of the report has been delayed. We believe today, however, that this information is valuable for the knowledge of prehistoric cultigens, and it is, therefore, being published with slight modifications in the original manuscript, as a result of recent fundamental changes which have come about in our knowledge of the archaeology of the Peruvian Coast. With reference to the subject,

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[2]The section on description of maize remains was worked and written by Paul C. Mangelsdorf and Julián Cámara-Hernández.

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only a few general notes were advanced (*vide* Kelley and Bonavia, 1963; Mangelsdorf and Cámara-Hernández, 1967), which are now being complemented with the present technical report on the botanical material.

The present report, nevertheless, is a preliminary one. The work at Huarmey has not been concluded, and a final and more thorough study is in preparation.

Up to this time, the site appears in the scientific literature with the denomination of Huarmey North 1, because a name was not known for that site. From now on we will call it Los Gavilanes, an old toponimic which the dwellers of the locality recall and its code will be PV35-1, according to Rowe's nomenclature.

The locality of Huarmey is in the Valley of Huarmey, which is in the Department of Ancash, Province of Casma, District of Huarmey in the North Central Coast of Peru. The archaeological site which is being described is located in the lower part of the Valley, exactly at 78°10'21'' longitude West and 10°02'45'' latitude South. The site, which was originally located by Edward Lanning, was a subject of interest of David H. Kelley, who made some test pits in the years 1957 and 1958. At the request of Paul C. Mangelsdorf, who at that time was Director of the Botanical Museum of Harvard University, in the year 1960 Duccio Bonavia excavated two stratigraphic cuts at the site and returned to it on numerous occasions in order to effect further observations. However, it is only in 1974 that Bonavia was able to make a more detailed and thorough work, still regarded as preliminary, on account of the size of the site and the complexity that it represents.

This site is located in a sandy area, removed from the cultivated area of the Valley, and a small range of hills separated it from the sea, while in its northern limit the remains of a fossil lagoon can be traced. This lagoon was formed on the bed of an ancient river, which is now dry and as a consequence of the conformation of ocean beach lines.

The site is totally covered by a layer of eolic sand and on its surface can be observed patterns of a series of structures, apparently circular, whose function is not yet clear. No ceramics are present on the surface, while lithic material is easily found. These are rough, simple tools, the majority with indefinite typology, made by percussion, and all of them on flakes. The only typical tools which characterize the site (and whose close counterparts are found only in the neighbouring Valley of Culebras and in a similar context), are some pebbles of various sizes, round or oval in shape, thin, and whose borders have been worked by unifacial percussion creating cutting edges.

When Kelley made the first preliminary excavation in the year 1967, he found one maize cob, peanut shells, abundant samples of cotton, fragments of gourds, and residues of sea shell and bones. It is presumed that one sample of lima bean was also present, although it was never identified by a specialist. Later on, Kelley himself in 1958 continued searching for more botanical evidence in the surroundings of his preliminary excavation site, having been able to find 10 maize cobs and a corn tassel. This material was shown to Mangelsdorf and because of its importance it was decided to go on with the search.

When Bonavia excavated the site in the year 1960, he was able to find abundant residues of corn (consisting not only of cobs and ears, but also leaves and plants) besides lithic residues (among which some disks which were mentioned before and one chipped stone point), textiles, mats and ropes. What called the attention most particularly was the finding of three pottery sherds during the excavations of the second stratigraphic cut. Two of them were at the base of the eolic sand, that is on the surface of the site, at a depth of 15 cms., while the third appeared without any control, because of the collapse of one of the walls of the cut; it could be presumed that this one was associated with the two previous ones.

The finding of these pottery sherds left some doubts about the possibility that the site could be pre-ceramic. However, in spite of many visits made by Bonavia to the site since 1960, he could never find on the surface other pottery fragments and during the excavations which took place in the season of 1974 nothing in the way of ceramic residues was found. Although the studies of the structures present a series of questions, in general terms all the cultural context which is associated with this corn belongs to the late pre-ceramic period of the Peruvian

Coast, what Lanning called Pre-ceramic VI (*vide* Lanning, 1967). Unfortunately, we are not in a position to analyze the three pottery fragments, a matter of controversy today, because they were delivered to Lanning for their study and have been lost. Judging, however, on the basis of the recollections of Bonavia who found them, because of their paste characteristic, they do not correspond to early pottery as known on the Peruvian Coast. Bonavia suggests that these fragments could well have been brought by fishermen who had a permanent transit route over the site or else they could have been deposited in the pre-hispanic period, long after the site was abandoned by its original dwellers. This statement is based on the fact that in the sandy areas surrounding the site, small surface sites have been found, which probably correspond to fishermen who came down from the Valley and stayed there for a short period of time, and they belong in time from the Middle Horizon up to the Late Horizon. The pottery found at Los Gavilanes should correspond to these occupations.

When the site was excavated in the year 1960 carbon samples were gathered in order to be utilized for dating through ^{14}C. Due, however, to an error, samples of corn were sent to laboratories for determinations. The results obtained were totally inconsistent since the date fluctations were between 200 and 800 years before the present era, with a margin of error varying between 70 and 95 years.

When this situation was investigated, we were informed that "corn cobs were particularly bad for use for ^{14}C dating, because growing corn had a most unusual rate of absorption of ^{14}C, giving a high content and indicating spuriously late dates" (Gary Vescelius, personal communication, 1970). Furthermore, there is a possibility of contamination of these samples, either through moisture in the deeper part of the site, in connection with the fossil lagoon, which is nearby, and which up to now maintains some vegetation through its humidity. Also the corn was subjected to multiple manipulations before it went through the ^{14}C process of dating.

Up to a few years ago the existence of pre-ceramic corn in Perú was not only doubted, its acceptance was even forthrightly refused by some archaeologists. Today the situation has changed and pre-ceramic corn is accepted by a number of specialists (*vide* Lanning, 1967 and Moseley, 1975).

The area of corn occurs through a coastal belt of approximately 150 kms. which extends from the famous site of Las Haldas (in the vicinity of Casma) to Aspero (near Supe) (*vide* Moseley, p. 89). Most of this corn belongs to the Late Preceramic that in terms of time means a period which extends from the year 2500 B.C. to the years 1800-1500 B.C. We think that in spite of existing doubts, the corn at Los Gavilanes is part of the same complex. New samples have been sent for new dating. At this time we have received two new datings, obtained on material excavated in the 1974 season, and which we believe form part of the same context to which plants excavated in 1960 belong.

The first dating was made by the method of thermoluminescence of burnt stones, at the Laboratoire de Cristallographie et de Physique Cristalline de la Faculté des Sciences of the University of Bordeaux, France. The result obtained is 4800±500 years BP (BOR 20). On the other hand, a sample of burnt wood from the same context was dated by the ^{14}C method at the Laboratoire du Radiocarbone du Comisariat à l'Energie Atomique et du Centre National de la Recherche Scientifique de Gif-sur-Yvette, France. The date obtained is 3750±110 years BP (GIF 3564).[1] Also, in an indirect form, the results of the work of the Ayacucho Archaeological-Botanical Project, directed by Richard MacNeish (*vide* MacNeish, Nelken-Terner and Garcia Cook, 1970) in some respects provides a logical explanation to the problem.

Though there are some questions, we believe that in the future these can be answered and that because of the dearth of botanical reports on the materials found at the pre-ceramic sites and because of the importance of the Huarmey corn, it is desirable that we publish the result of our studies, pointing out again that they are only of a preliminary nature.

Since this is a preliminary report, we have make no attempt to review the extensive literature that, in one way or another,

[1]Thanks are due to Claude Chauchat and Danièle Lavallée, for their help in securing the collaboration of this institution, and to Georgette Delibrias and Max Schvoerer of the two laboratories respectively, who made the actual datings.

has a bearing on our own findings. In a later, more complete report, we shall discuss some of the more recent contributions in South American archaeology that have come to our attention, notably an article by Zevallos *et al.*[2]

THE MAIZE REMAINS

The prehistoric remains of maize from the Huarmey site comprised a total of 238 specimens including all parts of the plant from the roots to anthers in the spikelets of the tassels. Their description follows:

COBS: Cobs, 61 specimens in all, were found at all levels in the pits. With respect to their size the cobs reveal an evolutionary sequence, those from the lower levels being generally shorter and more slender with fewer kernel rows and fewer spikelets per row. Since the majority of the cobs were not intact with respect to length and many of them were somewhat eroded, the only datum that could be obtained from all of the specimens was kernel-row number. The data for this characteristic are shown in TABLE 1, along with such other data as we

TABLE 1

Kernel-row numbers of the cobs from five stratigraphic levels. Level 1 is most superficial; level 5 is deepest.

Level	Kernel-row numbers				
	4	8	10	12	14
1			2	2	
2		4	8		1
3	1	15	5		
4		16	1		
5		2	1		

[2]Carlos Zevallos M., Walton C. Galinat, Donald W. Lathrap, Earl R. Leng, Jorge G. Marcos, Kathleen M. Klumpp. 1977. "The San Pablo corn kernel and its friends", *Science*, Vol. 196, pp. 385-389.

were able to obtain. The majority of the cobs from the three lowest levels were eight-rowed and none had more than ten rows. In contrast the majority of cobs in the two upper levels had more than eight rows and several had twelve or fourteen rows. One exceptional cob in level 3 (not included in Table 1) was distichous and had only four rows.

Accompanying an increase in kernel-row number was an increase in the diameter of the rachis and the total number of spikelets.

This conclusion is more a matter of observation than one of statistical averages since the number of intact cobs was limited. A trend can be illustrated, however, by comparing the intact cobs from levels 2, 3 and 4. The averages from these three levels are 133, 126 and 113 spikelets respectively.

The early cobs from this site appear to represent a weak form of pod corn. The glumes are quite long in relation to the diameter of the rachis and they are soft and fleshy; not like the indurated lower glumes of corn's relatives, teosinte or *Tripsacum*.

With respect to known races of maize of Peru, some of these cobs could be assigned to the Peruvian popcorn race Confite Morocho described by Grobman *et al.* (1961, Fig. 49). Like the slender cob illustrated by these authors the rachis is square in cross section and the cupules are shallow in outline. None of the cupules are as long as those of the unusually slender ear illustrated in Grobman *et al.* Cobs of this type are also quite fragile, breaking up easily into sections of one cupule each. Some of the smaller cobs have the stumps of terminal staminate spikes.

The early cobs, which comprise the majority of the collection may be related to the Peruvian race, Confite Morocho. This possibility is supported by cob morphology, number of kernel rows, which approaches an average of 8, kernel type, form and consistency of the glumes, etc. They bear also some resemblance to the Mexican race Chapalote, although they seem to be farther removed from it. Except for one cob, with four rows of spikelets and stiff lower glumes, which we would have classified as tripsacoid had we found it in the context of a Mexican ancient cob collection, all the others exhibited long, semi-tunicate, soft glumes. Tripsacoid cobs, such as those we would ascribe to the result of hybridization of corn with either teosinte or *Tripsacum*, simply do not appear in the Huarmey collection.

The Huarmey maize bears an interestingly close resemblance to the Confite Morocho maize obtained by MacNeish *et al.* (1970 p. 38), from the Ayacucho, Peru caves that he explored, and which was dated as circa 4300 to 2800 B.C. In all respects it also coincides with segregants described by Grobman *et al.* (1962) as Confite Morocho, from the Los Cerrillos site in Ica.

There are two exceptional cobs, one of which is illustrated in Plate 46A. This cob occurred in level 3. It is thick and tapering and has 14 kernel rows. It is quite similar to the predominating corn from the Huaca Prieta site described later.

Plates 45 and 46 illustrate the variation in the cobs from the lower to the upper levels of this site. The range in size is by no means as great as it is in the prehistoric cobs from the several caves in Mexico and the southwestern United States. This may indicate that a shorter span of time is involved or it may suggest that in the absence of contamination by teosinte or *Tripsacum* the rate of evolution is less rapid.

KERNELS: Only ten kernels were found. Several of these were immature and one was defective. The pericarp color in all kernels in which it could be determined was brown. The kernel shape, where it could be determined, was slightly pointed, (Fig. 1). Some ears of the Peruvian race Confite Morocho have kernels of this shape (Grobman *et al.*, 1961, Fig. 48).

Fig. 1. Enlarged diagram (2X) showing the shape of a kernel found in level 2. The shape is typical of the kernels of some ears of the Peruvian popcorn race Confite Morocho. All of the kernels found in this site have a brown pericarp color.

ROOTS AND STALKS: Five pieces of stalks with attached roots show mainly that the root system of prehistoric maize is virtually identical with that of modern maize. Diameters of the first internode above the root in the five specimens were 10.6, 4.3, 9.1, 7.1, and 9.4 mm. These dimensions are much smaller than those of the modern race Confite Morocho which has an average stalk diameter at the first internode of 16.0 mm. One of the five specimens had a split area on one side showing that it either had a tiller attached to it or was itself a tiller. This is the first archaeological evidence of tillering that we have encountered. (Plate 47)

One of the pieces with roots attached had four internodes which, measured from the base upward, had lengths of 51, 93, 143, and 141 mm. respectively. There was an undeveloped ear attached to the third node above the ground and the remains of a husk system attached to the fourth node. An internode pattern plotted from the data (Fig. 2) is similar to that of the modern Confite Morocho (Grobman *et al.*, 1961).

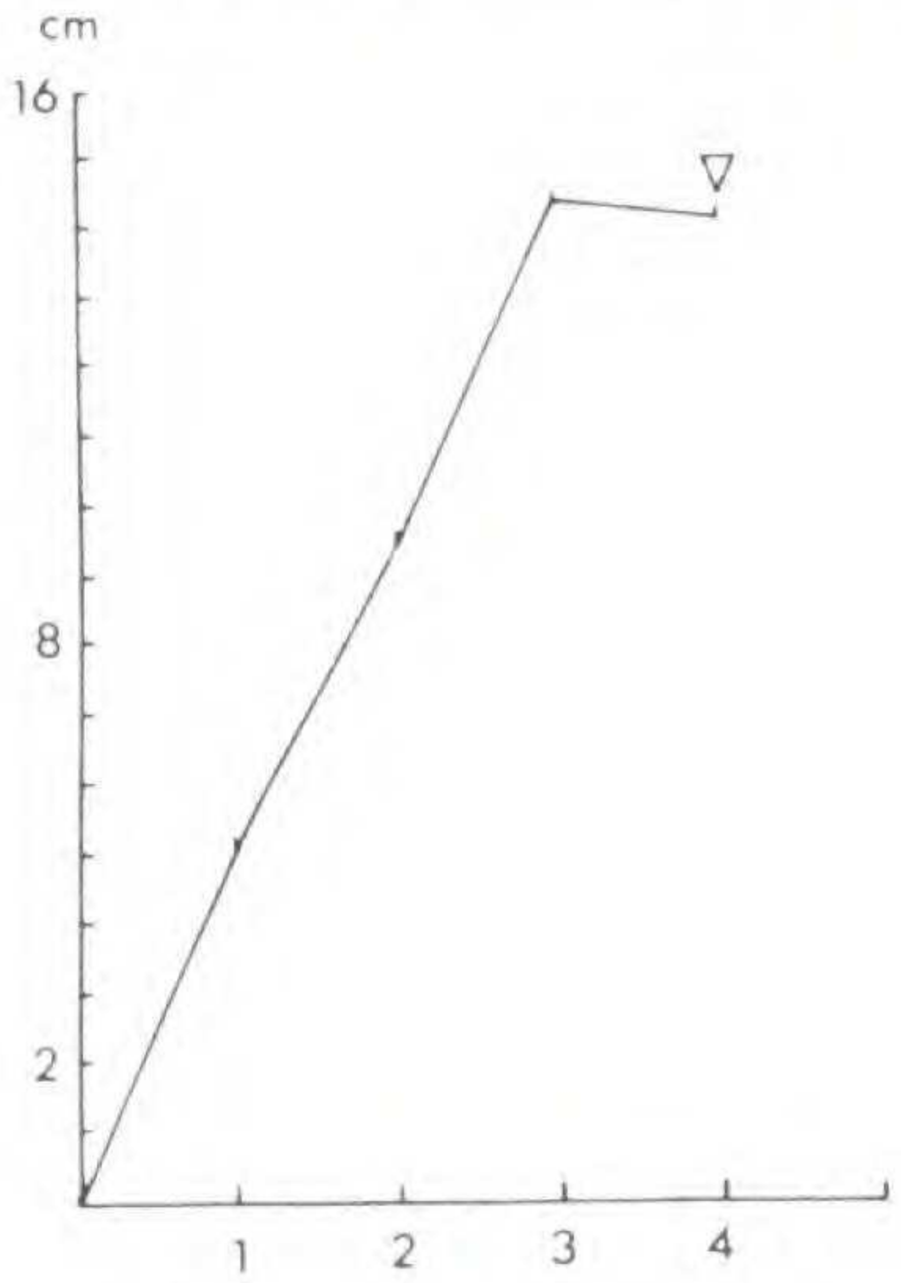


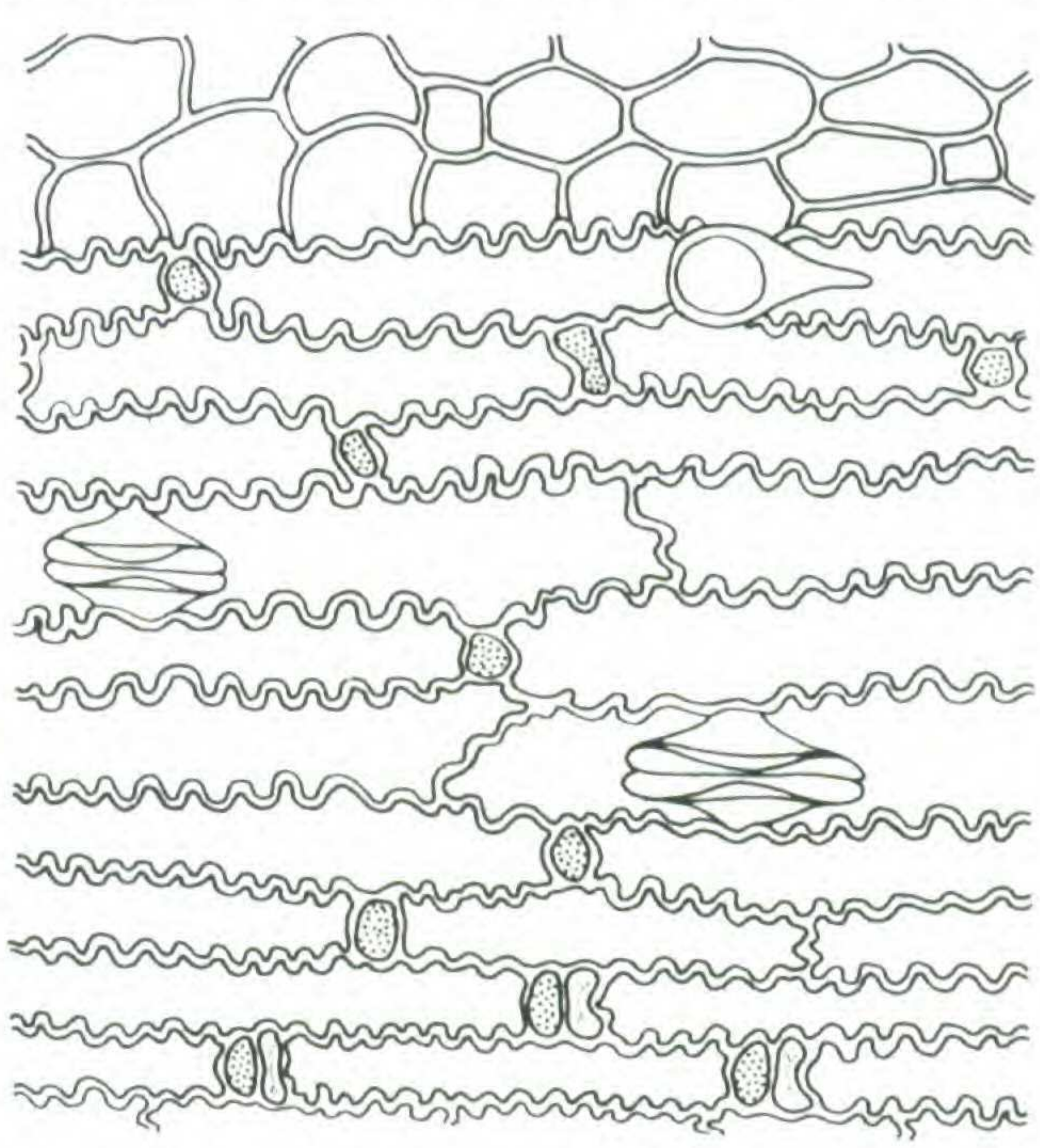
Fig. 2. Internode pattern up to the ear-bearing node of a stalk found in level 2. The pattern is almost identical with that of the Peruvian race Confite Morocho. cf. Grobman *et al.*, 1961, Fig. 51.

Ten pieces of stalk in addition to the five with attached roots were found. The diameter of these ranged from 5.6 to 12.8 mm., the average being 8.0 mm.

Leaf sheaths: Sixty-four specimens of leaf sheaths were identified. All of these were completely glabrous even lacking the weak pubescence usually found in modern varieties around the upper margins. In this respect the sheaths resemble those of the prehistoric corn from the caves in Tehuacán Valley. Some of the sheaths appear to have fitted rather loosely around the stalks; this is a characteristic which we have noted in some modern popcorn varieties and which have caused us to wonder whether it represents an adaptation to growth in regions of limited rainfall. We have often noticed that after a light shower in which the precipitation is not enough to wet the surface of the soil there is an area of moist soil surrounding the base of the stalks. What has happened is that rain falling on the leaves is directed toward the stalk moving from the upper leaves to the lower and finally to the soil at the base of the stalk where some of it probably reaches the roots. In plants with loose leaf sheaths, water funneled from the leaves is trapped in the spaces between the sheath and the stalk sometimes in substantial amounts so that puncturing the base of the sheaths causes a spurt of water. Can this trapped water be absorbed by the stalk? Plant physiologists to whom we have put this question have usually answered "probably" or words to that effect. However, a preliminary experiment that the senior author conducted with Galinat filling the sheath with water containing a vital dye showed no penetration of the dye into the tissues of the stalk. More refined experiments on this problem should be made. If water is not absorbed by the stalk it may be that at least it serves to reduce transpiration thus making the plant more efficient in its use of available moisture.

LEAVES: Leaves and fragments of leaves comprised fifty-one specimens. One of those from level 4 is illustrated in Plate 49. The leaf had a width of 46 mm. and a venation index of 3.9

Fig. 3. Diagram showing the anatomical features of the lower epidermis of a leaf found in level 3. The leaves of prehistoric corn have all of the characteristics of those of modern corn: bulliform cells, long cells, silica cells, cork cells, and stomata.



which is almost identical with the venation index 3.8 of modern Confite Morocho.

Cámara-Hernández made a study of the lower epidermis of a leaf from level 3 and found it to have all of the characteristics described by others: bulliform cells, long cells, silica cells, cork cells, and stomata. His drawing showing these typical maize features is reproduced in Fig. 3.

HUSKS: The husks of which there were 18 specimens are similar to those of modern maize except that they are shorter on the average and have more conspicuous parallel venation. There is a tendency for prominent veins to alternate with weaker ones. This is shown especially well in the photograph reproduced in Plate 48A. The anastomosing venation between two parallel veins is not completely lacking but it is less conspicuous than that usually found in the husks of modern varieties. The husks from any one level are much longer than the longest cobs from the same level (Fig. 4) suggesting at first glance that the ears were well protected against damage from ear worms and other insects by husks extending far beyond the tip of the ear. An almost intact husk system from level 3, however, indicates that the ears may have been exposed at maturity. The shank of this particular specimen had four inter-

Fig. 4. Diagram of a husk system found in level 3. The uppermost internode of this specimen was missing but a shred of its rind measuring 80 mm. remained showing that the peduncle of the ear must have been at least this long. The diagram of the cob is based on the longest cob found in this same level. The long peduncle suggests that the ear borne in such a husk system might have been exposed at maturity and capable of dispersing its seeds although enclosed and protected while young. The second internode from the base shows the scar of a branch which once must have been attached at this point and which bore a second ear. The general structure of husk systems such as these and the fact that the two outer husks are somewhat differentiated from the inner, raises the question whether in primitive maize a husk system bearing two ears might have been the homolog of the staminate spikelets bearing two florets. One-half actual size.

nodes measuring from the base upward: 11.5, 7.6, 9.3, 35.7 mm. respectively. The fifth internode was missing but a shred of its rind still remained and measured 79.5 mm. showing that the ear must have been borne on a long peduncle within the husk. This husk system with its fifth internode restored and terminated by the longest cob from the same level is shown diagramatically in Fig. 4. One of its noteworthy features is the scar of a branch on the second internode. Apparently husk systems of this type enclosed not a single ear but several, in this case probably two. A similar husk system from level 1 had the shred of a peduncle measuring 48 mm. in length. The original peduncle may have been considerably longer.

There is a tendency in these prehistoric husk systems for the two outer husks to be somewhat differentiated from the remaining inner ones in the thickness of the tissues. This is also true in modern varieties but the differentiation is by no means sharp, the transition from the outermost to the innermost being a gradual one. In the prehistoric husk systems the two outer husks are definitely thicker than the remaining inner ones which are almost tissue-paper like in their texture.

The husk system showing the differences between the outer and inner husks is illustrated in Plate 48B.

TASSELS, SPIKELETS, ANTHERS, AND POLLEN: Two almost complete tassels and 12 fragments were found. A diagram of one complete tassel is shown in Fig. 5. The tassels are similar to those of the Peruvian popcorn Confite Morocho (Grobman *et al.*, 1961, Fig. 50) in the number of tassel branches and their arrangement. (Plate 50).

The staminate spikelets of the prehistoric specimens are like those of modern maize, arranged in pairs, one member of each pair sessile the other pedicellate. Their glumes which are more rounded and less strongly keeled than those of many modern varieties, are beset with short hairs as are also the stems of the tassel branches. Spikelets from three tassel fragments in Level 4 had average glume lengths of 7.8 mm., from two tassels in Level 2, average lengths of 8.8 mm., and from 9 tassels in Level 1, average lengths of 7.5 mm. Although there is no evidence of an evolutionary series in the spikelets from these three levels,

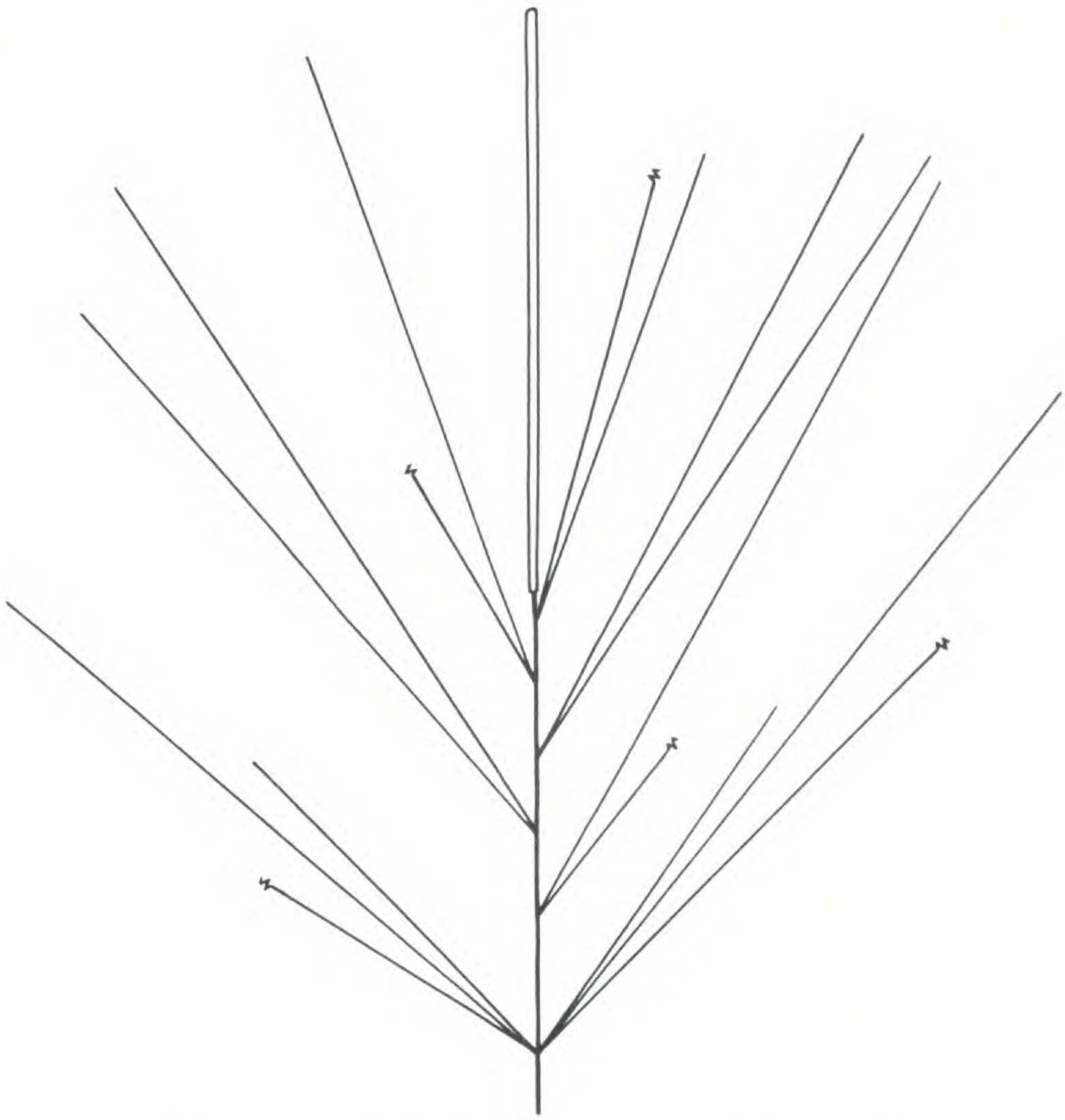


Fig. 5. Diagram of a tassel in level 2. Except for the shorter length of its central spike and branches, this tassel is almost identical with that of the Peruvian race Confite Morocho. cf. Grobman *et al.*, 1961, Fig. 50 One-fourth actual size.

all are shorter than those of most varieties of modern corn. The spikelets from the three tassels in Level 4 are almost identical in their dimensions to the earliest spikelets found in the Tehuacán site in Mexico.

Anthers containing pollen were found in three different tassels. Mounted in lactic acid the pollen grains swelled to the spherical, slightly oval shape characteristic of the pollen of modern maize. Pollen from two of the specimens included many empty grains, in one case 74 empty, 11 normal; in another 29 empty; 27 normal. The significance of these empty grains is not apparent. The normal grains from these anthers measured

80.6 and 78.1 microns in diameter. Those from a third specimen had an average diameter of 86.6 microns. These dimensions are similar to those of the pollen grains of modern races such as Nal-Tel and Palomero Toluqueño of Mexico, which have pollen diameters of 81.2 and 77.9 microns respectively (Galinat, 1961).

PROPHYLLS: Several of the husks systems, four in all, had their prophylls still attached. These are identical in their characteristics to those of modern maize in having two distinct prominent keels. These are illustrated in Plate 48B.

DISCUSSION

The specimens from the Los Gavilanes site in Huarmey, including all parts of the plant, show that the prehistoric maize from this site is virtually identical to modern maize in all its characteristics, except size. The plant-to-plant variability is less than that found in contemporary races collected at any single location. With a few exceptions the specimens can be assigned to the Peruvian popcorn race Confite Morocho, as it is found today growing in the low to middle altitudes in the Central Andes of Peru, and as it was grown in the same locations 6200 and 4700 years ago, as evidenced by MacNeish's finds in Ayacucho, Peru caves (*vide* MacNeish *et al.* 1970).

There seems to be little doubt, if any, that the Los Gavilanes maize is representative of corn grown on the Central North Coast of Peru, at a late pre-ceramic period, and that it was introduced to the Coast from the highlands of Peru at least about 5,000 years ago.

Although there is some resemblance between the early Los Gavilanes maize and early popcorn of Mexico of the Chapalote race, it is premature to speculate on the possible significance of the similarities. It may be that early maize had similar overall morphological characteristics, and this is to be expected, as the forces of mutation, selection, and hybridization would not have had the time after domestication at various sites, to effect the profound qualitative and quantitative changes in morphology that are apparent in maize today. Yet, one thing is common in the early Mexican and Peruvian corn, and that is the almost total absence of evidence of introgression with teosinte or *Tripsacum*. Tripsacoid corn is not alien to Peruvian archaeological corn, but it appears at much later periods, which would indicate either influx into the Peruvian area of corn which hybridized with *Tripsacum* in either the lowlands east of the Andes, or in the Coast of the Chocó area of Colombia, or of Central America or Mexico, or which hybridized with teosinte in Mexico or Central America. At any rate, this introduction would have occurred much later in history.

Summary

1. A collection of maize from a site named Los Gavilanes, located in the North Central Coast of Peru, in the Huarmey valley is analyzed. Judging from evidence available up to this time, the site corresponds to the Late Pre-ceramic of the cultural chronology of the Andean pre-hispanic Epoch. If it is true that certain problems concerning it still exist, there is concrete evidence that confirms the existence of this cultigen before the introduction of pottery on the Peruvian Coast.
2. The collection comprises 238 specimens including all parts of the plant, from the roots to the anthers and pollen grains.
3. The cobs reveal an evolutionary sequence from the lower to the higher levels. In their characteristics they resemble the Peruvian popcorn race Confite Morocho.
4. The stalks of the prehistoric corn are more slender than those of modern corn. The leaf sheaths are completely glabrous. The leaves have all the anatomical characteristics of those of modern corn. The husks are much longer than those of the longest cobs. This is regarded as evidence that a single husk system may have enclosed more than one ear.
5. The spikelets of the tassel are similar to those of modern corn being in pairs, one member sessile, the other pedicelled. Pollen grains are similar in size to those of modern

races of popcorn. The pattern of branching in the tassels is similar to that of the Peruvian popcorn race Confite Morocho.

6. The prehistoric maize from Huarmey is significant in differing in its characteristics from two other Peruvian coast sites, Huaca Prieta and Ica.

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PLATE 45

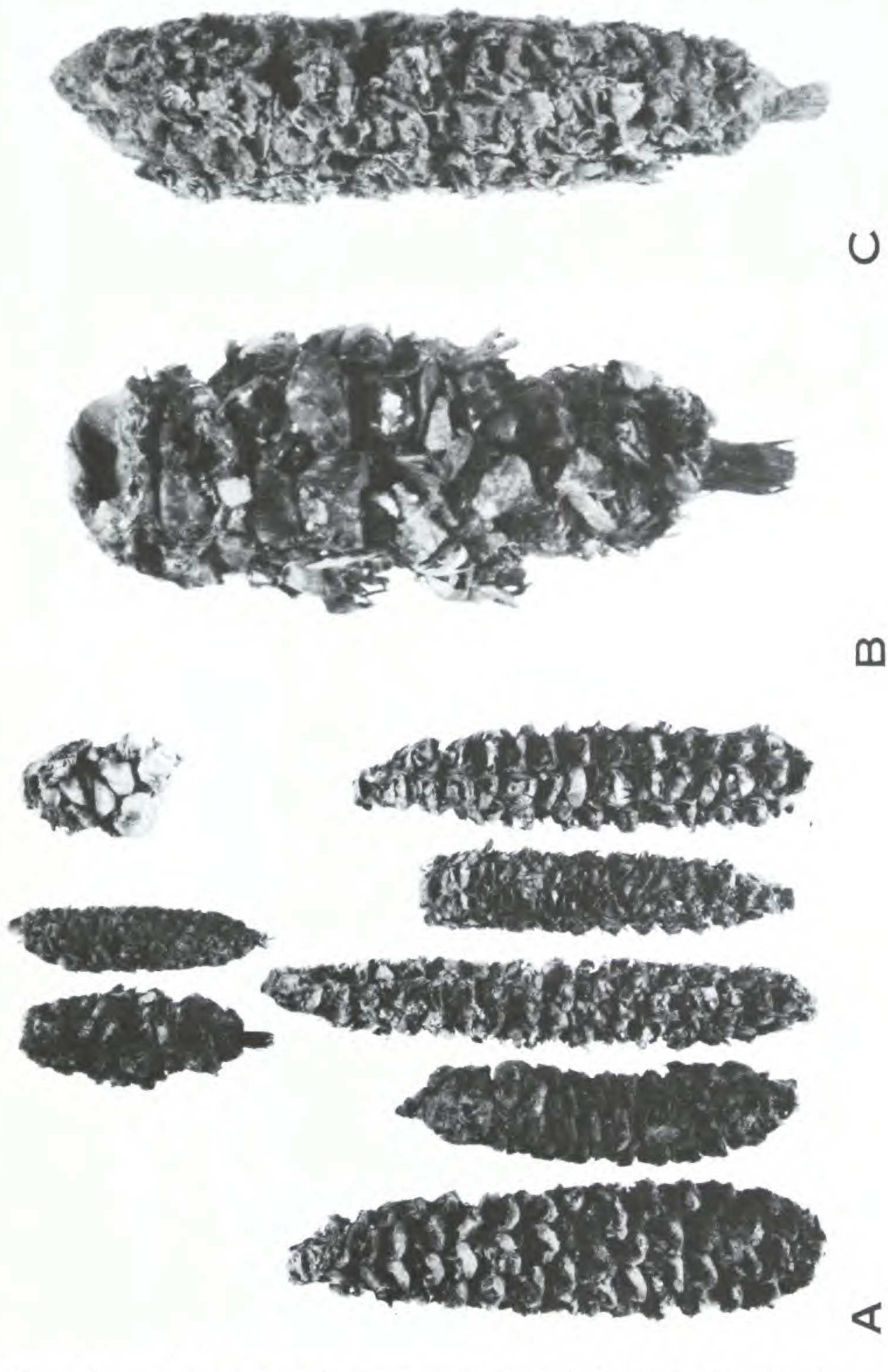

Plate 45. A, Upper right. Fragment of a cob from level 5. The long soft glumes indicate that this was a form of pod corn; upper center, two small cobs from level 4. Lower, typical cobs from level 4, actual size. B. enlargement x2.74, one of the small cobs from level 4 shown in A. C. Similar enlargement of the other small cob from level 4 shown in A.

PLATE 46

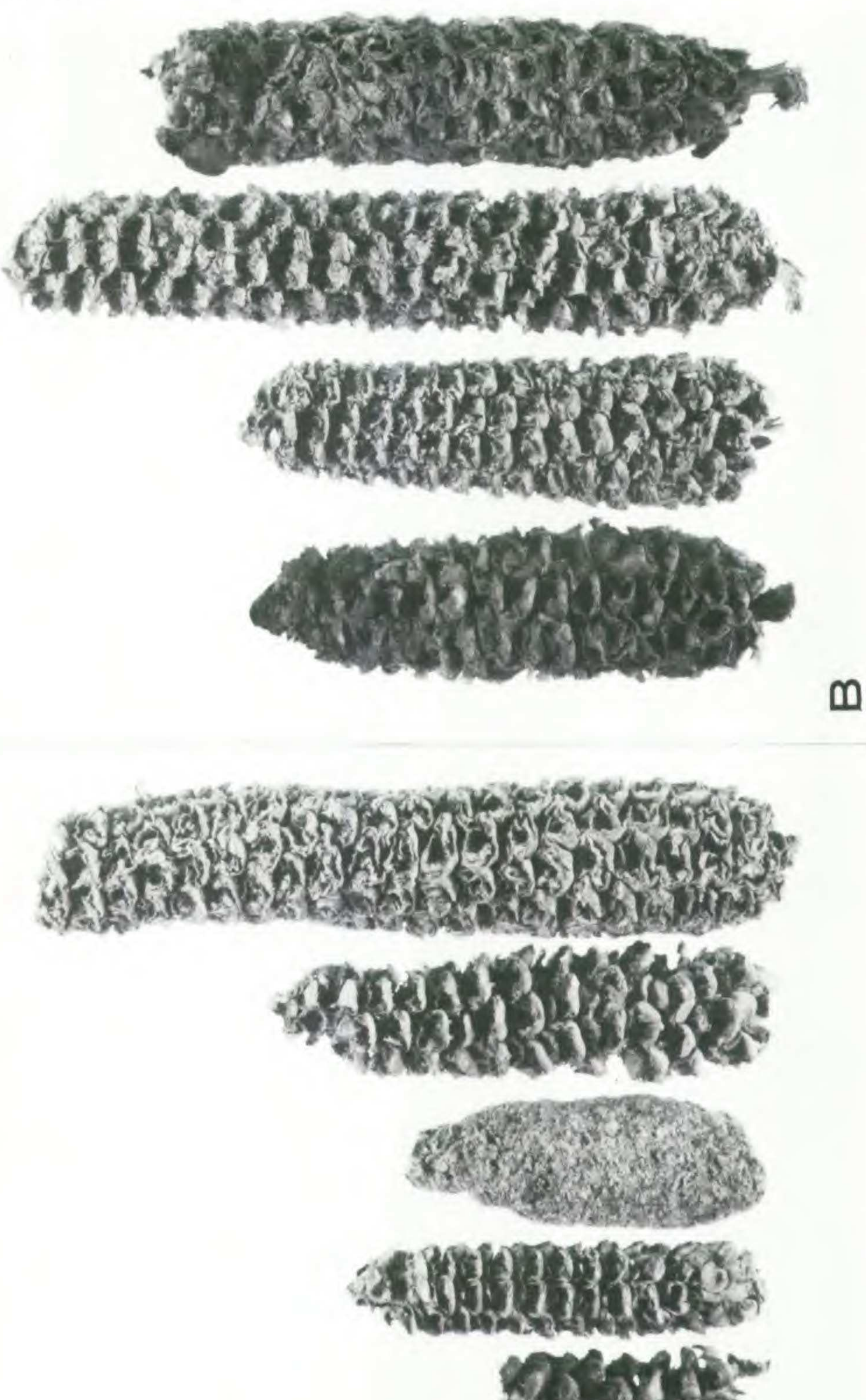

Plate 46. A. Representative cobs from level 3. The center cob is not typical of this collection but resembles some of the cobs from the Huaca Prieta site. B. Representative cobs from level 2. Actual size.

PLATE 47

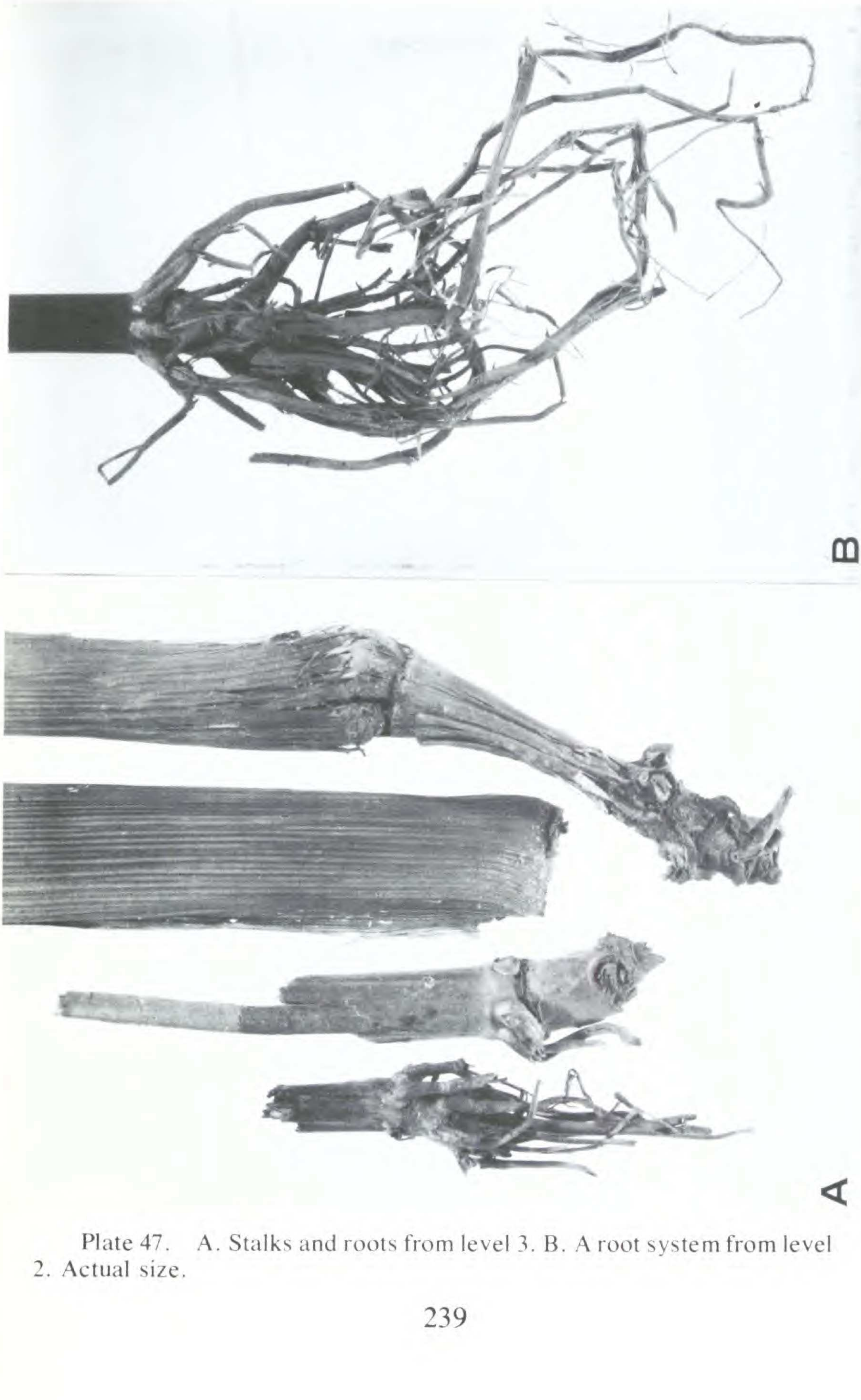

Plate 47. A. Stalks and roots from level 3. B. A root system from level 2. Actual size.

PLATE 48

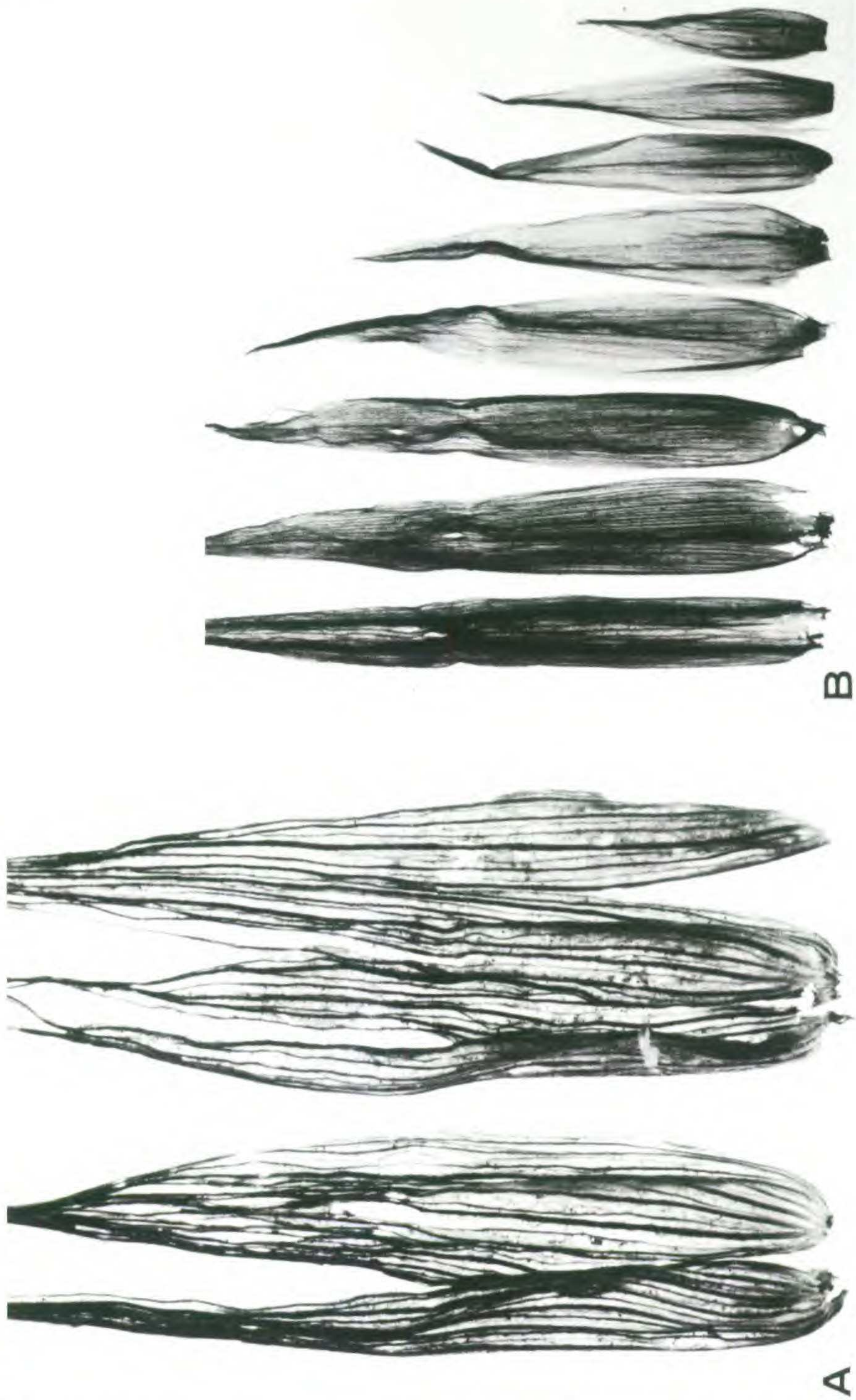

Plate 48. A. The two outer husks of a husk system from level 4 illuminated from below to show the prominent parallel venation associated with a tendency for strong veins to alternate with weaker ones. Actual size. B. A prophyll and successive husks from an undeveloped second ear on a stalk from level 2. Note the prominent keels of the prophyll and the fact that the two outer husks are thicker than the inner ones suggesting a degree of differentiation. Actual size.

PLATE 49

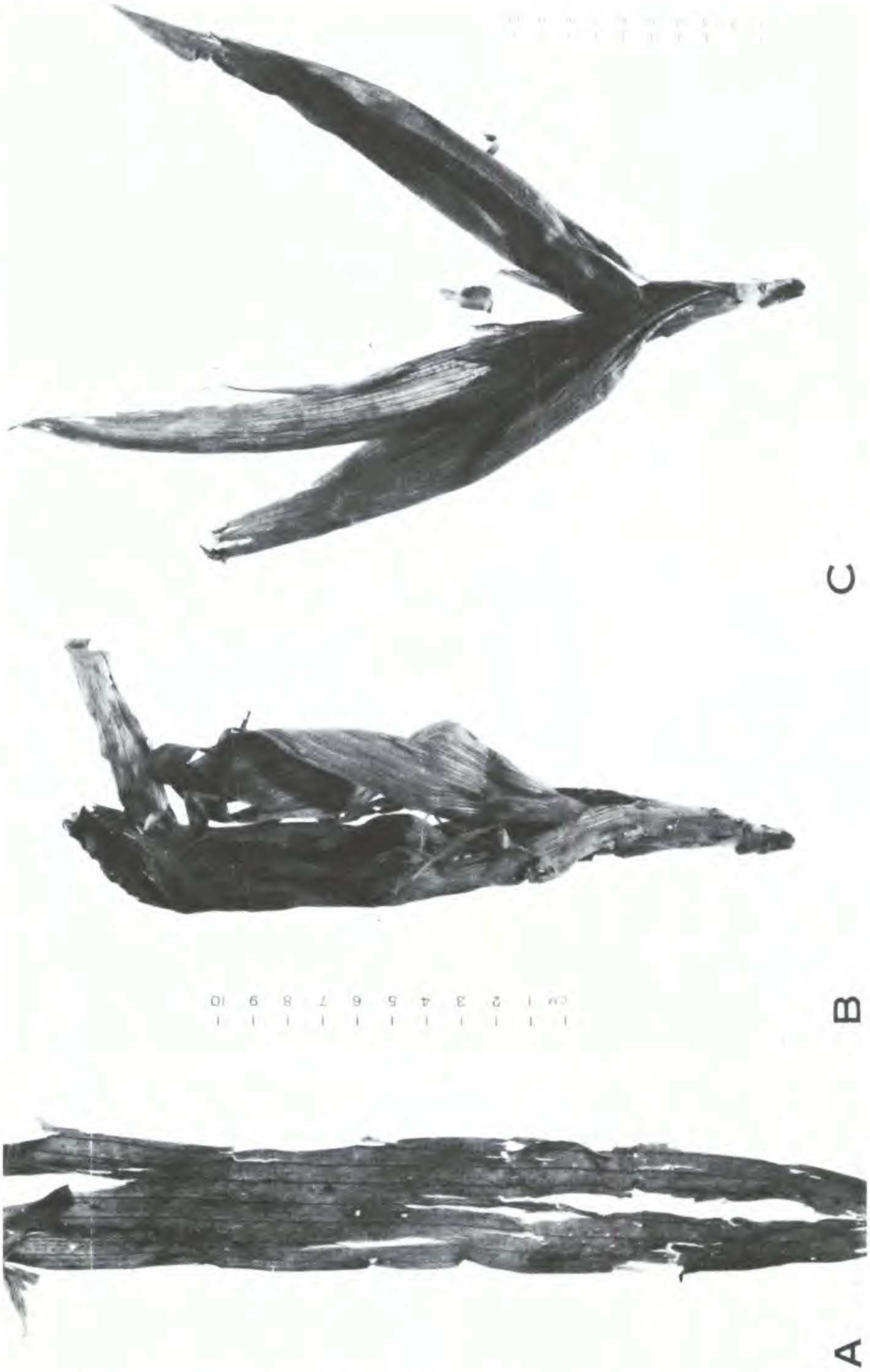

Plate 49. A. Part of a leaf blade from level 4. A drawing illustrating the anatomy of the lower epidermis is reproduced in Fig. 3 and shows that the characteristics of the epidermis of prehistoric corn are similar to those of modern corn. Actual size. B. A husk system from level 2, one-half actual size. C. A husk system from level 2 showing the shred of a broken peduncle indicating that the ear enclosed by this husk system was borne on a relatively long peduncle. One-half actual size. Another husk system of this kind is illustrated by the diagram in Fig. 4.

PLATE 50

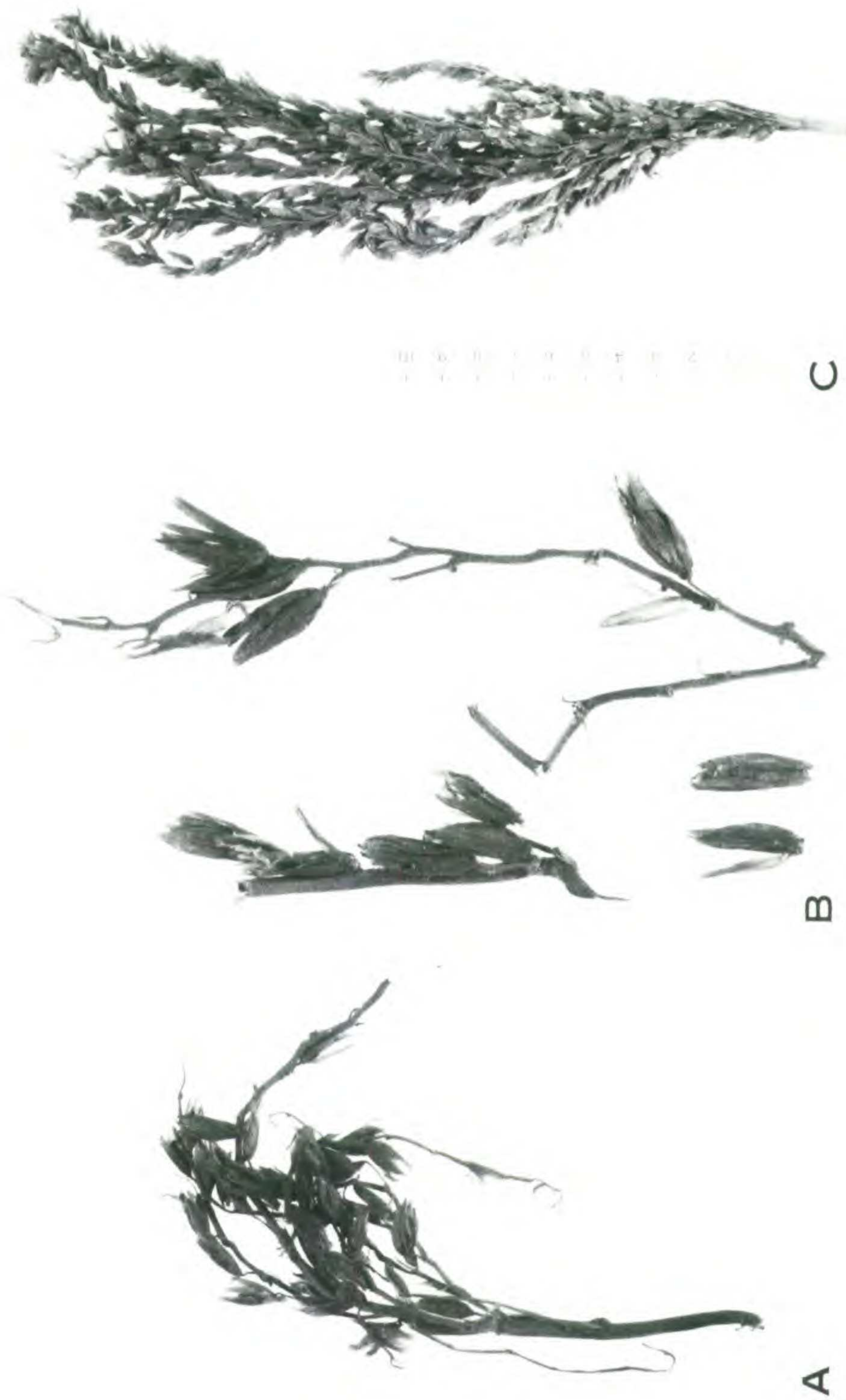

Plate 50. A. Part of a tassel from level 4. Actual size. B. Fragment of a tassel from level 5 showing the relatively small spikelets. Actual size. C. A complete tassel from level 2. A central spike is present but is much less prominent than in the tassels of modern corn. One-half actual size.